

## CLAIMS

I/We claim:

1. A method for assembling microelectronic dies, comprising:
  - placing a base die on a substrate in a first die attach head of a die attach machine so that a front side of the base die with bond pads faces toward the substrate and a backside of the base die faces away from the substrate; and
  - stacking a first stacked die onto the backside of the base die in a second head of the same die attach machine by dispensing an adhesive onto the backside of the base die and placing a backside of the first stacked die onto the adhesive, wherein the first stacked die is stacked onto the base die before securing the base die to the substrate in a heating cycle.
2. The method of claim 1, further comprising heating the base die and the first stacked die in a single heating cycle to secure the base die to the substrate and to secure the first stacked die to the base die.
3. The method of claim 1 wherein:
  - the base die comprises a flip-chip die and placing the base die on the substrate comprises depositing a solder flux onto at least one of the flip-chip die and/or the substrate and then pressing the flip-chip die onto the substrate so that the bond-pads are electrically coupled to contacts on the substrate; and
  - stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the flip-chip die and then heating the flip-chip die and the wire-bond die together to reflow the solder flux and cure the adhesive in a single heating cycle.

4. The method of claim 1 wherein:

the base die comprises a flip-chip die and placing the base die on the substrate comprises depositing an underfill material onto at least one of the flip-chip die and/or the substrate and pressing the flip-chip die onto the substrate so that the bond-pads are electrically coupled to contacts on the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the flip-chip die and then heating the flip-chip die and the wire-bond die together to cure the adhesive in a single heating cycle.

5. The method of claim 1 wherein:

the base die comprises a board-on-chip die and placing the base die on the substrate comprises depositing an adhesive onto at least one of the board-on-chip die and/or the substrate and then pressing the board-on-chip die onto the substrate so that the bond-pads are aligned with a slot in the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the board-on-chip die and then heating the board-on-chip die and the wire-bond die together to cure the adhesive under the board-on-chip die and the adhesive under the wire-bond die in a single heating cycle.

6. The method of claim 1, further comprising;

stacking a second stacked die onto the first stacked die in a third die attach head of the same die attach machine by depositing an adhesive on the first stacked die and placing the second stacked die on the first stacked die before heating the base die and the first stacked die; and

heating the base die, the first stacked die, and the second stacked die to cure the adhesive under the first stacked die and the adhesive under the second stacked die.

7. The method of claim 1, further comprising automatically transferring the substrate and the base die from the first die attach head to the second die attach head.

8. The method of claim 1, further comprising transferring the substrate and the base die from the first die attach head to the second die attach head without loading the substrate and the base die into a separate die attach machine.

9. The method of claim 1, further comprising placing the base die on the substrate and stacking the first stacked die onto the base die in a single pass through a single die attach machine.

10. A method for assembling microelectronic dies, comprising:  
preparing a substrate to receive a base die in a first die attach head of a die attach machine;

placing the base die on the substrate in the first die attach head so that a front side of the base die with bond pads faces toward the substrate and a backside of the base die faces away from the substrate;

moving the base die to a second die attach head of the same die attach machine without heating the base die;

stacking a first stacked die onto the base die in the second die attach head by dispensing an adhesive onto the backside of the base die and placing the first stacked die onto the adhesive in the second die attach head.

11. The method of claim 10, further comprising heating the base die and the first stacked die in a single heating cycle to secure the base die to the substrate and to secure the first stacked die to the base die.

12. The method of claim 10 wherein:

the base die comprises a flip-chip die and placing the base die on the substrate comprises depositing a solder flux onto at least one of the flip-chip die and/or the substrate and then pressing the flip-chip die onto the substrate so that the bond-pads are electrically coupled to contacts on the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the flip-chip die and then heating the flip-chip die and the wire-bond die together to reflow the solder flux and cure the adhesive in a single heating cycle.

13. The method of claim 10 wherein:

the base die comprises a flip-chip die and placing the base die on the substrate comprises depositing an underfill material onto at least one of the flip-chip die and/or the substrate and pressing the flip-chip die onto the substrate so that the bond-pads are electrically coupled to contacts on the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the flip-chip die and then heating the flip-chip die and the wire-bond die together to cure the adhesive in a single heating cycle.

14. The method of claim 10 wherein:

the base die comprises a board-on-chip die and placing the base die on the substrate comprises depositing an adhesive onto at least one of the board-on-chip die and/or the substrate and then pressing the board-on-chip die onto the substrate so that the bond-pads are aligned with a slot in the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the board-on-chip die and then heating the board-on-chip die and the wire-bond die together to cure the adhesive under the board-on-chip die and the adhesive under the wire-bond die in a single heating cycle.

15. The method of claim 10, further comprising;  
stacking a second stacked die onto the first stacked die in a third die attach head of the same die attach machine by depositing an adhesive on the first stacked die and placing the second stacked die on the first stacked die before heating the base die and the first stacked die; and

heating the base die, the first stacked die, and the second stacked die to cure the adhesive under the first stacked die and the adhesive under the second stacked die.

16. A method for assembling microelectronic dies, comprising:  
placing a base die on a substrate in a first die attach head of a die attach machine by dispensing a preparation material onto the base die and/or the substrate and pressing the base die onto the substrate so that a front side of the base die with bond pads faces toward the substrate and a backside of the base die faces away from the substrate; and

stacking a first stacked die onto the backside of the base die in a second head of the same die attach machine by dispensing an adhesive onto the backside of the base die and placing a backside of the first stacked die onto the adhesive, wherein the first stacked die is stacked onto the base die before heating the preparation material under the base die.

17. The method of claim 16, further comprising heating the base die and the first stacked die in a single heating cycle to secure the base die to the substrate and to secure the first stacked die to the base die.

18. The method of claim 16 wherein:  
the base die comprises a flip-chip die and placing the base die on the substrate comprises depositing a solder flux onto at least one of the flip-chip die and/or the substrate and then pressing the flip-chip die onto the substrate so that the bond-pads are electrically coupled to contacts on the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the flip-chip die and then heating the flip-chip die and the wire-bond die together to reflow the solder flux and cure the adhesive in a single heating cycle.

19. The method of claim 16 wherein:

the base die comprises a flip-chip die and placing the base die on the substrate comprises depositing an underfill material onto at least one of the flip-chip die and/or the substrate and pressing the flip-chip die onto the substrate so that the bond-pads are electrically coupled to contacts on the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the flip-chip die and then heating the flip-chip die and the wire-bond die together to cure the adhesive in a single heating cycle.

20. The method of claim 16 wherein:

the base die comprises a board-on-chip die and placing the base die on the substrate comprises depositing an adhesive onto at least one of the board-on-chip die and/or the substrate and then pressing the board-on-chip die onto the substrate so that the bond-pads are aligned with a slot in the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the board-on-chip die and then heating the board-on-chip die and the wire-bond die together to cure the adhesive under the board-on-chip die and the adhesive under the wire-bond die in a single heating cycle.

21. The method of claim 16, further comprising;

stacking a second stacked die onto the first stacked die in a third die attach head of the same die attach machine by depositing an adhesive on the first stacked die and placing the second stacked die on the first stacked die before heating the base die and the first stacked die; and

heating the base die, the first stacked die, and the second stacked die to cure the adhesive under the first stacked die and the adhesive under the second stacked die.

22. A method for assembling microelectronic dies, comprising:

placing a base die on a substrate in a first die attach head of a die attach machine by dispensing a preparation material onto the base die and/or the substrate and pressing the base die onto the substrate so that a front side of the base die with bond pads faces toward the substrate and a backside of the base die faces away from the substrate; and

stacking a first stacked die onto the backside of the base die in a second head of the same die attach machine by dispensing an adhesive onto the backside of the base die and placing a backside of the first stacked die onto the adhesive, wherein the first stacked die is stacked onto the base die before reflowing the preparation material under the base die.

23. A method for assembling microelectronic dies, comprising:

placing a base die on a substrate in a first die attach head of a die attach machine so that a front side of the base die with bond pads faces toward the substrate and a backside of the base die faces away from the substrate;

stacking a first stacked die onto the backside of the base die in a second head of the same die attach machine by dispensing an adhesive onto the backside of the base die and placing a backside of the first stacked die onto the adhesive; and

altering a preparation material used to couple the base die to the substrate and curing the adhesive used to adhere the first stacked die to the base die in a single heating cycle after attaching the first stacked die to the base die.

24. The method of claim 23 wherein:

the base die comprises a flip-chip die and placing the base die on the substrate comprises depositing a solder flux onto at least one of the flip-chip die and/or the substrate and then pressing the flip-chip die onto the substrate so that the bond-pads are electrically coupled to contacts on the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the flip-chip die and then heating the flip-chip die and the wire-bond die together to reflow the solder flux and cure the adhesive in a single heating cycle.

25. The method of claim 23 wherein:

the base die comprises a flip-chip die and placing the base die on the substrate comprises depositing an underfill material onto at least one of the flip-chip die and/or the substrate and pressing the flip-chip die onto the substrate so that the bond-pads are electrically coupled to contacts on the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the flip-chip die and then heating the flip-chip die and the wire-bond die together to cure the adhesive in a single heating cycle.

26. The method of claim 23 wherein:

the base die comprises a board-on-chip die and placing the base die on the substrate comprises depositing an adhesive onto at least one of the board-on-chip die and/or the substrate and then pressing the board-on-chip die onto the substrate so that the bond-pads are aligned with a slot in the substrate; and

stacking the first stacked die onto the backside of the base die comprises placing a wire-bond die onto the board-on-chip die and then heating the board-on-chip die and the wire-bond die together to cure the adhesive under the board-on-chip die and the adhesive under the wire-bond die in a single heating cycle.

27. The method of claim 23, further comprising;  
stacking a second stacked die onto the first stacked die in a third die attach head of the same die attach machine by depositing an adhesive on the first stacked die and placing the second stacked die on the first stacked die before heating the base die and the first stacked die; and  
heating the base die, the first stacked die, and the second stacked die to cure the adhesive under the first stacked die and the adhesive under the second stacked die.

28. The method of claim 23, further comprising automatically transferring the substrate and the base die from the first die attach head to the second die attach head.

29. The method of claim 23, further comprising transferring the substrate and the base die from the first die attach head to the second die attach head without loading the substrate and the base die into a separate die attach machine.

30. The method of claim 23, further comprising placing the base die on the substrate and stacking the first stacked die onto the base die in a single pass through a single die attach machine.

31. A method for assembling microelectronic dies in a stacked die assembly, comprising:

depositing a flux onto a substrate;  
placing a flip-chip die on the substrate in a first die attach head of a die attach machine to electrically couple ball-pads on a front side of the flip-chip die to contacts on the substrate, wherein a backside of the flip-chip die faces away from the substrate;

stacking a wire-bond chip onto the flip-chip in a second die attach head of the same die attach machine by dispensing an adhesive on the backside of the

flip-chip and mounting a backside of the wire-bond chip to the backside of the flip-chip; and

reflowing the flux and curing the adhesive in a heating process after stacking the wire-bond chip onto the flip-chip.

32. The method of claim 31, further comprising;  
stacking a second stacked die onto the first stacked die in a third die attach head of the same die attach machine by depositing an adhesive on the first stacked die and placing the second stacked die on the first stacked die before heating the base die and the first stacked die; and

heating the base die, the first stacked die, and the second stacked die to cure the adhesive under the first stacked die and the adhesive under the second stacked die.

33. The method of claim 31, further comprising automatically transferring the substrate and the base die from the first die attach head to the second die attach head.

34. The method of claim 31, further comprising transferring the substrate and the base die from the first die attach head to the second die attach head without loading the substrate and the base die into a separate die attach machine.

35. The method of claim 31, further comprising placing the base die on the substrate and stacking the first stacked die onto the base die in a single pass through a single die attach machine.

36. A method for assembling microelectronic dies in a stacked die assembly, comprising:

depositing an underfill material onto a substrate;

placing a flip-chip die on a substrate in a first die attach head of a die attach machine to electrically couple ball-pads on a front side of the flip-chip die to corresponding contacts on the substrate, wherein a backside of the flip-chip die faces away from the substrate;

stacking a wire-bond chip onto the flip-chip in a second die attach head of the die attach machine by dispensing an adhesive on the backside of the flip-chip and mounting a backside of the wire-bond chip to the backside of the flip-chip; and

heating the underfill material and the adhesive in a single heating cycle after stacking the wire-bond chip to the flip-chip.

37. The method of claim 36, further comprising;

stacking a second stacked die onto the first stacked die in a third die attach head of the same die attach machine by depositing an adhesive on the first stacked die and placing the second stacked die on the first stacked die before heating the base die and the first stacked die; and

heating the base die, the first stacked die, and the second stacked die to cure the adhesive under the first stacked die and the adhesive under the second stacked die.

38. The method of claim 36, further comprising automatically transferring the substrate and the base die from the first die attach head to the second die attach head.

39. The method of claim 36, further comprising transferring the substrate and the base die from the first die attach head to the second die attach head without loading the substrate and the base die into a separate die attach machine.

40. The method of claim 36, further comprising placing the base die on the substrate and stacking the first stacked die onto the base die in a single pass through a single die attach machine.

41. A method for assembling microelectronic dies in a stacked die assembly, comprising:

depositing a base adhesive onto a substrate adjacent to a slot in the substrate;

placing a board-on-chip die on a substrate in a first die attach head of a die attach machine by pressing a front side of the board-on-chip die against the base adhesive so that bond-pads on the board-on-chip are aligned with the slot in the substrate and so that a backside of the board-on-chip die faces away from the substrate;

stacking a wire-bond chip onto the board-on-chip in a second die attach head of the die attach machine by dispensing a second adhesive on the backside of the board-on-chip and mounting a backside of the wire-bond chip to the backside of the board-on-chip; and

heating the base adhesive material and the second adhesive in a single heating cycle after stacking the wire-bond chip to the board-on-chip.

42. The method of claim 41, further comprising;

stacking a second stacked die onto the first stacked die in a third die attach head of the same die attach machine by depositing an adhesive on the first stacked die and placing the second stacked die on the first stacked die before heating the base die and the first stacked die; and

heating the base die, the first stacked die, and the second stacked die to cure the adhesive under the first stacked die and the adhesive under the second stacked die.

43. The method of claim 41, further comprising automatically transferring the substrate and the base die from the first die attach head to the second die attach head.

44. The method of claim 41, further comprising transferring the substrate and the base die from the first die attach head to the second die attach head without loading the substrate and the base die into a separate die attach machine.

45. The method of claim 41, further comprising placing the base die on the substrate and stacking the first stacked die onto the base die in a single pass through a single die attach machine.

46. A system for fabricating a stacked die assembly, comprising:  
a first station having a first die storage mechanism containing plurality of flip-chip dies, a first dispense mechanism for preparing a substrate for receiving a flip-chip die, and a first die attach head for placing a front side of the flip-chip die on the substrate so that bond-pads on the front side face toward the substrate and a backside of the flip-chip die faces away from the substrate;

a second station proximate to the first station, the second station having a second storage mechanism containing a plurality of wire-bond dies, a second dispense mechanism for dispensing an adhesive onto the backside of the flip-chip die, and a second die attach head for mounting a backside of the wire-bond die to the backside of the flip-chip die; and

a transfer mechanism for transferring the base die mounted to the substrate directly to the second station in a single pass process.

47. A system for fabricating a stacked die assembly, comprising:  
a first station having a first die storage mechanism containing plurality of board-on-chip dies, a first dispense mechanism for preparing a substrate for receiving a board-on-chip die, and a first die attach head for placing a front side of

the board-on-chip die on the substrate so that bond-pads on the front side face are aligned with a slot in the substrate and a backside of the board-on-chip die faces away from the substrate;

a second station proximate to the first station, the second station having a second storage mechanism containing a plurality of wire-bond dies, a second dispense mechanism for dispensing an adhesive onto the backside of the board-on-chip die, and a second die attach head for mounting a backside of the wire-bond die to the backside of the board-on-chip die; and

a transfer mechanism for transferring the base die mounted to the substrate directly to the second station in a single pass process.